California Regional Water Quality Control Board
Santa Ana Region

May 16, 2003

ITEM: 10

SUBJECT: Status Report on Beach Water Quality in the Santa Ana Region

1. Introduction

This report provides a summary of the status of beach water quality in the Santa Ana Region and provides a summary of beach water closures due to sewage spills and beach postings due to violations of water quality standards. The beaches in the Santa Ana Region (Figure 1) include Seal Beach and Sunset Beach north of the entrance to Huntington Harbour, Bolsa Chica State Beach, Huntington City Beach, Huntington State Beach, Newport Beach, the Corona del Mar beaches, Crystal Cove State Beach, and the beaches and channels in Huntington Harbour and Newport Bay. The good news is that, when it is not raining, more than 99% of the region's beaches, along the Orange County coastline and within Newport Bay and Huntington Harbour, met water quality standards during 2002. In fact, at the majority of the region's beaches, concentrations of indicator bacteria are significantly lower than the body contact recreation water quality objectives in the California Ocean Plan. This means that, at most beaches, most of the time, there is an insignificant and unquantifiable risk to public health from swimming in the Pacific Ocean, Newport Bay, or Huntington Harbour when it isn't raining. However, there are a few isolated beach water quality problems in the region, such as at Huntington State Beach near the mouth of the Santa Ana River, which require Regional Board action to correct significant water quality threats.

The most significant loss of body contact recreation beneficial use at the region's beach waters occurs when it rains. Approximately 12% of the region's available beach mile days (BMDs) were lost due to discharges of polluted urban runoff and rain. (beach mile day = number of miles of coastline times the number of days.) The region has approximately 33,470 available BMDs in each year, with 10,220 available BMDs along the coast, 11,315 BMDs within Huntington Harbor, and 14,600 BMDs in Newport Bay. The local health officer issues a rain advisory for people not to swim in the ocean during and after rain events greater than 0.02 inches, because of the high concentrations of bacterial indicators in the runoff. There may be some areas of the ocean not impacted by rain runoff discharges, depending on the volume of runoff. However, when it rains, the Orange County Health Care Agency (OCHCA) advises the public not to swim in Newport Bay, Huntington Harbour, and the Pacific Ocean for at least three days after each rain event greater than 0.02 inches. During very large storm events, the pollution in

the ocean may last for more than 3 days, again depending on the volume of runoff discharged.

On an annual basis, approximately 13.5% of the available annual beach mile days at the beaches in the region were lost in 2002 due to discharges of polluted rain, urban runoff, and sewage spills. Of these, more than 12% of the available beach mile days in the region were lost due to rain, less than 0.03% were lost due to sewage spills, and the remainder were lost due to discharges of polluted urban runoff and other sources of fecal waste.

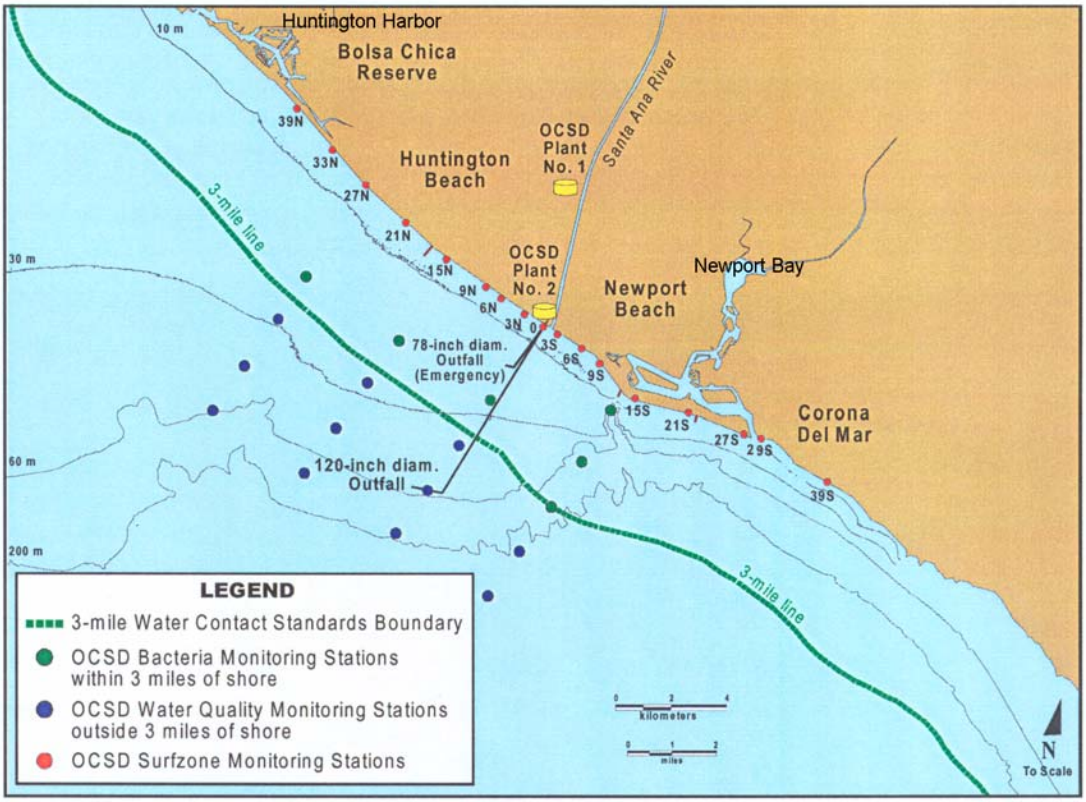

Figure 1: Beaches in the Santa Ana Region
(OCSD, 2002)

There are also localized beach water closures and postings, some of which may pose a minor threat to public health and have negative economic impacts to the region. Measured water quality, at an approximate 1-3 mile section of Huntington State Beach from the Santa Ana River north to the AES power plant at Newland Street (Station 9N in Figure 1), exceeded the body contact water quality objectives between 5% and 65% of the time during 2002, depending on the monitoring location and the distance from the river mouth. There are also

chronic beach water quality problems at numerous locations in Newport Bay and Huntington Harbour that result in violations of water quality standards. Staff has received and reviewed a report of the economic impacts of beach water pollution at Huntington and Newport Beach, in which it was estimated that over $5.5 million per year in added health care costs were generated due to illnesses in the community from swimming at these beaches. (Dwight, et al 2003) Staff believes the assumptions about the number of cases of illnesses may have been overestimated, considering the good water quality measured at most locations along this stretch of coastline. As discussed later, Dwight's estimates of the number of illnesses may not be completely supportable, because it is impossible to extrapolate a dose response relationship for enterococci densities below the Ocean Plan water quality objective, and these estimates are not based on actual epidemiology data from the area.

There are also other costs associated with beach pollution. Work to support the American Trader oil spill case resulted in an estimate of economic loss due to this oil spill of approximately $15 per person per day of beach use lost. Therefore, as an example, if 100 people avoid the beach because of the pollution on any given day during the year, or the perception that the beach is polluted, the local economy could loose more than $500,000 per year. (100 people/day avoid beach x 365 days x $15/person/day)

Staff believes that the evidence in the record clearly shows that dry weather discharges of urban runoff cause and contribute to the violations of water quality objectives. Urban runoff discharges also contribute to violations of water quality standards during rain events. These discharges of urban runoff are in violation of the area wide stormwater NPDES permit.

The following discussion provides a summary of the beach closures and postings in the region and concludes with recommendations for further action by the Regional Board and other agencies to further reduce and eliminate the sources of bacterial pollution causing these beach closures and postings.

2. Current Beach Closures and Postings

The California Health and Safety Code establishes the water quality standards that are used by the local Health Officer to determine if beach water should be closed to body contact recreation or posted as being in violation of water quality standards. The Health Officer is required to close a beach if there is evidence of sewage in the water, regardless of whether monitoring data shows violations of objectives. The Health Officer must also post a notice of contamination if the county's monitoring shows water quality to exceed any of the established water quality standards in the Health and Safety Code. In both cases, there is a loss of beneficial use of the waters of the State, violations of water quality standards in the Basin Plan, and violations of the water quality objectives outlined in Table 1.

Staff relies on OCHCA's notifications to the public of beach pollution, but uses the Ocean Plan water quality objectives for bacteria to determine whether beach water quality meets the water quality standards and objectives. The Basin Plan incorporates the Ocean Plan objectives by reference, and these objectives are more statistically significant, and actually more stringent, than the AB411 standards. Therefore, staff has used the Ocean Plan water quality objectives in the compliance analysis for this report. Staff has also evaluated only compliance with the water quality objectives for enterococci bacteria, because this is the only indicator bacteria with sufficient scientific justification for the estimated illness rates in relation to concentration in the water. (USEPA, 1986) The USEPA has recommended that total and fecal coliform bacteria not be used to regulate bacterial water quality for the protection of public health and to ensure compliance with the Clean Water Act.

Table 1: Ocean Plan Water Quality Objectives and Health and Safety Code Objectives

	Ocean Plan Objectives		AB411 Standards	
	Daily Max	30-Day Geomean	Inst. Max	30-day Geomean
Total Coliform	10%>230	70/100 mL median	10,000	1,000
Fecal Coliform	400	200	400	200
Enterococci		24 (6 Mo. GM =14)	104	35

Both the Ocean Plan objectives and the AB411 Standards for enterococci are based on USEPA criteria developed in 1986. These criteria are shown in Table 2 and are based on studies showing that 19 out of 1000 people swimming in water with a 30-day geometric mean density of enterococci of 35/100 mL could have a Highly Credible Case of Gastroenteritis (HCGI). Table 3 also includes the 75%, 82%, and 95% confidence levels for the geometric mean densities listed, which are used as the single sample criteria. The AB411 Standards use the 75% confidence level for the single sample standards. It is important to note that the USEPA has extrapolated the illness rates for enterococci densities less than 14/100 mL, which resulted in a 14 out of 1000 illness rate. The studies do not show a significant illness rate below 14 enterococci/100 mL. A recent meta-analysis of the USEPA criteria, which evaluated all the available epidemiology data used by the USEPA in development of the criteria for enterococci, has confirmed that the data do not support estimated illness rates below the EPA criteria. (Wade & Colford, 2003). Therefore any estimates of illness rates below the criteria are extrapolations and not supported by the evidence. However, these extrapolated illness rates can be used to show that the illness rate would at least be below the 19 out of 1000, when enterococci densities are less that the 35/100 mL criteria. According to a "Public Health Risk Assessment for the Newport Bay Watershed", (EOA, September 2001) the USEPA criteria are based on a risk level that is slightly greater than the background level of risk for HCGI in the general population, which is approximately 10 out of 1000.

Table 2: USPA Water Quality Criteria for Enterococcus Bacteria

Illness Rate (per 1000)	Geometric Mean Density	Single Sample Maximum Allowable Density		
		Designated Beach Area 75% C.L.	Moderate Full Body Contact Recreation 82% C.L	Infrequently Used Full Body Contact 95% C.L.
8	*4*	*13*	*20*	*63*
9	*5*	*16*	*24*	*76*
10	*6*	*19*	*29*	*91*
11	*8*	*23*	*35*	*110*
12	*9*	*28*	*42*	*133*
13	*11*	*33*	*51*	*161*
14	**14**	**40**	**61**	**195**
15	**16**	**49**	**74**	**235**
16	**20**	**59**	**90**	**284**
17	**24**	**71**	**108**	**343**
18	**29**	**86**	**131**	**415**
19	**35**	**104**	**158**	**501**

(USEPA, 2002)
(Bold numbers supported by epidemiology, italic numbers not supported)

Table 3 summarizes beach closures at beaches in Orange County in the Santa Ana Region (OCHCA, 2002). The table includes the total numbers of beach closures caused by sewage spills, and breaks down the beach closures between the Coastal Beaches (Seal Beach, Sunset Beach, Bolsa Chica State Beach, Huntington City Beach, Huntington State Beach, Newport Beach, and Crystal Cove State Beach), Newport Bay, and Huntington Harbour. The table lists the total number of beach closures, the total days the beaches were closed, and the total beach mile days of beneficial uses of the beach water that was lost due to the closure. (beach mile day = number of days of closure X length of beach closed) The beach mile day provides a good measure of the relative impact of each beach closure, the loss of beneficial use, and the magnitude of the violation of water quality standards. Table 3 includes the total annual available beach mile days for the beaches in the Santa Ana Region, and breaks down the available beach mile days between the coastal beaches, Newport Bay, and Huntington Harbour. Table 3 also includes the available beach mile days for the period of the year when the AB411 standards are in effect (April 1st-October 31st). However, in Orange County, the OCHCA applies the criteria year-round, because of the year-round use of the County's beaches.

Table 3: Summary of Beach Closures Due to Sewage Spills in the Santa Ana Region

Year	Number of Beach Closures	Number of Days Closed	Total Beach Mile Days Closed	% of Available BMD Lost	Available BMDs Beach Miles	AB411 BMD 214 days	Annual BMD
Total					92	19623	33470
1999	6.5	25	6.39	0.02			
2000	15	46	11.75	0.04			
2001	27	95	15.4	0.05			
2002	27	92	10.41	0.03			
Coastal Beaches					28	5992	10220
1999	0	0	0	0.00			
2000	5	19	9.73	0.10			
2001	10	32	9.29	0.09			
2002	6	24	2.06	0.02			
Huntington Harbor					31	6634	11315
1999	3	20	5.71	0.05			
2000	2	5	0.22	0.00			
2001	6	25	3.92	0.03			
2002	8	26	3.34	0.03			
Newport Bay					40	8560	14600
1999	2	5	0.28	0.00			
2000	8	22	1.8	0.01			
2001	11	39	2.19	0.02			
2002	13	42	5.07	0.03			

Huntington Beach 1999-105.1 BMDs non-sewage spill closure
Huntington Beach 2002-11.3 BMDs non-sewage spill closure

Table 3 shows that 20% (in BMD) or 22% (of total number of closures) of the region's beach closures due to sewage spills occur along the shoreline, with 49% and 31% occurring at several locations in Newport Bay and Huntington Harbour, respectively. The beach closures in the region have remained constant over the past few years, with the loss of approximately 10 to 15 beach mile days of beneficial uses of the ocean and bay waters. Beach closures along the coast accounted for 2 to 9 of these BMDs. Almost half of the lost BMDs of body contact recreation occurred in Newport Bay. There also appears to be an increasing trend in beach closures due to sewage spills and the loss of beneficial use in Newport Bay, from 2 BMDs in 1999 to 13 BMDs in 2002. Table 3 shows that sewage spills caused the loss of less than 0.03% of the available beach mile days in 2002, and reflects the apparently increasing trend of sewage spill discharges into Newport Bay causing beach closures.

The OCHCA also posts notices at beaches where monitoring data show that the concentrations of total coliform, fecal coliform, E-coli, and/or enterococcus

bacteria exceed one or more of the applicable water quality standards. We believe OCHCA's and OCSD's beach monitoring programs are the best in the world and provide a very thorough characterization of beach water quality in the region. Table 4 summarizes the total number of postings of the violations of water quality standards, the total days that were posted in violation, and the total beach mile days of lost beneficial use of the Pacific Ocean and bay waters as the result of this pollution. The table also includes the beaches, channels, and marina areas in Newport Bay (43rd Street Beach, 33rd Street Beach, Channel and Harbor Tower Marina) where the OCHCA has permanent signs posting notices of contamination due to suspected polluted urban runoff sources for 2001 and 2002. The cause of these violations of water quality standards is probably the discharge of urban runoff, which can include sewage from spills, leaks and other illegal discharges of sewage, pet waste, and other sources of pathogens and indicator bacteria. Birds and other wildlife may contribute to the pollution at any of the region's beach. However, there is no evidence showing that birds and wildlife, alone, are the sole cause of violations at any of the region's beaches.

Table 4: Summary of Violations of Water Quality Standards Caused by Urban Runoff and other sources at Beaches in the Santa Ana Region

Year	Number of Beach Postings of Violations	Number of Days of Violation	Total Beach Mile Days Posted	% of Available BMD Lost
Total				
2000	185	1035	142.39	0.43
2001	252*	4662*	204.8*	0.61
2002	232*	4965*	327.27*	0.98
Coastal Beaches				
2000	88	458	116.96	0.35
2001	102	2445	113.16	0.34
2002	128	3031	117.93	0.35
Huntington Harbor				
2000	27	196	8.61	0.08
2001	56	549	23.16	0.20
2002	43	423	150.98	1.33
Newport Bay				
2000	70	381	16.82	0.12
2001	94	1668	68.48	0.47
2002	61	1511	58.36	0.40

*The significant increase of postings during 2001 and 2002 is the result of the inclusion of permanent postings at several creek mouths and storm drain discharge points. OCHCA permanently posts the mouth of the Santa Ana River and Talbert Marsh, other small drains and creek mouths along the coast, and numerous drains discharging into Huntington Harbor and Newport Bay. Data for 1999 are not included in the table because data is available for only a portion of the year.

Table 3 and 4 do not include the rain advisory days issued by the OCHCA and the REC-1 beneficial use lost due to discharges of polluted storm water runoff during and after rain events. The OCHCA advises that people should stay out of the ocean water for 3 days following the last rain, because of known high bacterial pollution loads in rain runoff. During 2002, the OCHCA issued 8 rain advisories for a total of 49 days that violate water quality standards due to rain runoff, combined with the urban runoff. The rain advisories resulted in the loss of recreational water use at all of the region's beaches and the loss of more than 4,356 Beach Mile Days of beneficial use of waters of the State. Compared to the 10 BMD lost due to sewage spills and the 327 BMD lost due to urban runoff discharges and other sources, this shows that the loss of beach use during and after rain events greatly exceeds the loss of beneficial use due to sewage spills or discharges of only dry weather urban runoff and other sources. However, as discussed below, beach closures at Huntington State Beach due to the discharge of urban runoff are still significant.

3. Huntington Beach Closures and Postings and Economic Impacts

The monitoring data used by the OCHCA to generate the information in Table 4 shows that there is still a significant beach water quality problem, even when it isn't raining, along a short section of Huntington State Beach. The discharge from the Santa Ana River to the ocean routinely exceeds the Ocean Plan bacterial criteria, and this appears to be a source of the beach pollution that extends along the beach from the river mouth for more than 9000 feet north. These data imply that, when the County diverts the urban runoff from the lower Santa Ana River and discharges this runoff to the sewer, there appears to be a decrease in the number and extent of violations of water quality standards. The County diverts the urban runoff to the sewer between April 15 and October 15. However, staff has been unable to obtain the specific dates the diversion was put in place and removed to properly analyze the data. When the urban runoff diversion is not in place, there are chronic violations of the 30-day geomean objective in the ocean from the river mouth 9000 feet north, indicating a chronic source of pollution.

According to a Draft Report entitled "Orange County Stormwater Program Dry Weather Diversion Study" (RBF Consulting, February 2003), there has been a decrease in the number of days of violation of water quality objectives along Huntington Beach from 151 in 1999 to 65 in 2001, following the diversion of urban runoff to the sewer system from the Talbert and Santa Ana River drainage systems. Diversion of urban runoff also decreased the number of violations of water quality objectives at the Dunes Resort in Newport Bay from 23 in 2000 to 5 in 2002. This draft report shows that diversions of urban runoff have been effective in reducing violations of water quality objectives at the Region's beaches.

Table 5 provides a summary of the number of days each month during 2002 when there were violations of water quality objectives along the Huntington Beach and Newport Beach shoreline, monitored 5 days per week by the OCSD. Table 5 shows that the discharge from the Santa Ana River violates the geomean water quality objective more than 58% of the year, and that this discharge of polluted urban runoff causes and contributes to violations of water quality standards along a 1-2 mile stretch of the Pacific Ocean north of the river mouth. (Figure 2 shows the monitoring stations listed in Table 5 and other features.) The monitoring data for the Santa Ana River at Pacific Coast Highway (PCH) appear to show a significant decrease in the number of days of violations of water quality criteria, when the County of Orange starts diverting more than 1 million gallon per day of polluted runoff from the Santa Ana River, and approximately 600,000 gallons per day from the Greenville Banning Channel. The diversions are put in place in late April and early May, resulting in an improvement in water quality along the entire shoreline north of the river mouth.


Adams Ave
Indianapolis Ave
Atlanta Ave
Huntington Beach Pier
21N
15N
Construction Site
Pacific Coast Highway
Power Plant Facility
9N
6N
3N
0
3S
Hamilton Ave
Bernard St
Santa Ana River
OCSD Plant No. 2
Figure 2: Huntington Beach Aerial Location Map
City/County Stormwater Pump Stations
OCSD Surfzone Monitoring Stations
from Santa Ana River (0) in ~1,000 ft increments North and South, 6N ~6,000 ft North of River

Table 5: Summary of Violations of Ocean Plan Water Quality Objectives-Number of Days each month in Violation Huntington Beach Shoreline for 2002

Total Coliform Median Objective (70/100ml)/30-day fecal objective(200/100ml)/30-day enterococci objective(24/100ml)

	39N	33N	27N	21N	15N	9N	6N	3N	D2	0	SAR
					Huntington Beach Pier	Newland	Magnolia	Brookhurst	Talbert	SAR Mouth	at PCH
January	0	0	0	14	16	0	6	31	22	0	31
February	0	0	0	0	0	0	13	11	0	0	28
March	0	0	0	2	0	1	31	31	11	0	31
April	0	0	0	0	0	0	28	21	7	5	28
May	0	0	0	0	0	0	0	9	0	24	0
June	0	0	0	0	0	0	0	0	0	0	22
July	0	0	0	0	0	0	12	0	0	0	29
August	0	0	0	0	0	0	0	0	0	0	13
September	0	0	0	0	0	7	5	0	0	11	0
October	0	0	0	0	0	22	7	0	0	0	0
November	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	24	11	0	31	30	20	30	29
Total	0	0	0	40	27	30	133	133	60	70	211
% of year in violation	0	0	0	11%	7.4%	8.2%	36.4%	36.4%	16.4%	19.2%	58%

Table 5 continued: Summary of Violations of Ocean Plan Water Quality Objectives- Number of Days of Violation per Month for 2002

Total Coliform Median Objective (70/100ml)/30-day fecal objective(200/100ml)/30-day enterococcui objective(24/100ml)

Newport Beach Shoreline

	3S	6S	9S	15S	21S	29S	39S				
				Newport Pier	Balboa Pier	Wedge	Crystal Cove				
January	3	0	0	0	0	0	0				
February	0	0	0	0	0	0	0				
March	0	0	0	0	0	0	0				
April	2	0	0	0	0	0	0				
May	0	0	0	0	0	0	0				
June	0	0	0	0	0	0	0				
July	0	0	0	0	0	0	0				
August	0	0	0	0	0	0	0				
September	0	0	0	0	0	0	0				
October	0	0	0	0	0	0	0				
November	0	0	0	0	0	0	0				
December	13	9	5	12	0	0	0				
Total	18	9	5	12	0	0	0				
% of year in violation	5%	2.5%	1.4%	3.3%	0	0	0				

According to Dwight, Fernandez, Baker, Semenza, and Olson, of UC Irvine, in "Economic Burden from Illness Associated with Recreational Waters", the gastroenteritis and other illnesses associated with recreational marine waters in Huntington and Newport Beach may cause more than $5 million per year in health costs, and an economic burden to Orange County. These researchers estimated the number of illnesses that may occur along the Newport and Huntington Beach shoreline if the water quality "just met" the water quality objectives, which are based on an illness rate of 19 out of 1000. Since water quality along 90% of this section of shoreline routinely has water quality that is better than that required by the objective, this estimate of economic impact is high. Using the analysis by Dwight, et. al., staff has estimated that there may be as many as 1,500 to 3,000 cases per year of HCGI due to the pollution at Huntington State Beach based on measured water quality, which could increase health care costs to the community by as much as $150,000 per year.

Staff's estimate of the possible number of illnesses at Huntington Beach is close to a revised estimate of recreational health risk provided in Environmental Health Perspectives (Turbow, April 2003), which used both the USEPA criteria epidemiology data and the results of the Santa Monica Bay study (Haile, et.al. Journal of Epidemiology, January 1999) to estimate the number of cases of HCGI that may occur at Huntington Beach. Dwight, et al. had used earlier estimates by Trubow, et al. in their estimate of economic impacts of increased health care costs. The Santa Monica Bay study by Haile and others show that there is a significant risk of illness from swimming in the ocean near a storm drain outlet discharging urban runoff, as compared to the control group which were swimming some distance away from the discharge point. However, this work also showed that the risk of swimming in polluted urban runoff, at concentrations at or above the USEPA criteria for enterococcus bacteria, was significantly less than the risk of swimming in a wastewater plume with similar enterococci densities. Turobow estimates that approximately 2,056 cases of HCGI could occur at Huntington State Beach based on measured water quality and the disease/response work of Haile.

In addition to health care costs and lost work due to illness, there are additional economic impacts caused by beach closures in Huntington Beach. When one considers that more than 5 million people use this section of beach per year, and between 1,500 and 3,000 people may become ill from swimming in this section of the Pacific Ocean, there can be a substantial impact to the local economy from this condition of pollution. There is also a cost to the community when people avoid the beach because of the pollution, or the perception of the pollution. Using the beach valuation from the American Trader oil spill case, of $15 per person per beach day lost, there could be between $500,000 and $5 million per year in lost economic activity, if between 100 and 1000 people per day avoid the beach because of the pollution.

4. Source Investigations and Controls

Recently, numerous investigators/researchers have conducted studies along the Huntington Beach shoreline, to provide additional information to the Board and the public about the pollution problem. Dr. Stanley Grant of UCI finished another phase of his Coastal Runoff Impact Study (CRIS), under contract with the National Water Research Institute, who funded the study along with the Regional Board and the County of Orange. The City of Huntington Beach followed up on numerous potential sources identified in the OCSD Sanitary Survey from the previous year. The California Energy Commission commissioned and completed a study of the AES power plant. OCSD has completed their offshore investigation of their discharge, and due to their disinfection of the offshore discharge, bacteria exceeding AB411 standards from the discharge outside the zone of initial dilution are no longer detected.

Dr. Stanley Grant, and his research collaborators from UC Irvine have been investigating the impact of urban runoff discharged from the Santa Ana River and Talbert Marsh, under contract with the National Water Research Institute, the County of Orange, and the Regional Board. The main findings of Dr. Grant are that urban runoff is a major source of fecal indicator bacteria in the shore zone, and that Talbert Marsh is a net source of enteroccocus bacteria to the shore zone. Dr. Grant's team also used new genetic testing methods and have found male specific bacteriophage and nucleic acid indicative of hepatitis-A virus. These source tracking methods indicate that there may be sources of human waste in the discharge from the Santa Ana River. However, these source tracking methods are still experimental and have been found to have a high number of false positives. These findings do not show viable viruses or pathogens, but do raise serious questions of the potential health risk of the beach water pollution, and continue to show that there is probably still some unidentified source in the area of monitoring stations 6N and 9N, north of the Santa Ana River. In summary, Dr. Grant's monitoring evidence provides strong support for his conclusions:

1. The Santa Ana River is a source of total coliform bacteria to the shorezone at Huntington State Beach, but there is some other source of fecal coliform and enterococci bacteria at 6N and 9N.
2. The source of fecal indicator bacteria in the Santa Ana River is urban runoff.
3. Dissolved concentration ratios of cholesterol:caffeine:water from the Santa Ana River and Newport Slough outlets are below those ratios indicitive of human sewage sources.
4. Fecal Indicator Viruses (FIV), RNA and DNA F+ coliphage, were detected at all of the coastal stations, but because serotypes of these phage come

from feces from humans and warm blooded animals, this source tracking method is inconclusive with regards to source.

5. No human adenovirus nucleic acid was found using a DNA source tracking test method, in any of the 54 samples tested. Enterovirus nucleic acid was detected in 3 samples, and 11 of the 54 samples tested positive for hepatitis-a viral nucleic acid. The positive tests for F+ RNA phage nucleic acid coincided with an offshore cooling and upwelling event, which indicates a possible offshore source of coliphage.
6. Postings for exceedances of single sample criteria are meaningless. No better than flipping a coin to decide if beach should be posted as polluted or not. However, monthly geometric mean bacteria concentrations do identify water quality problems. The 40 years worth of monitoring by the OCHCA and OCSD clearly show changes in bacterial water quality along the shore due to changes in wastewater treatment and disposal, diversions of urban runoff, and fixing leaking sewers.
7. The pollution at 6N probably began in 1997, or earlier.

Dr. Grant and his team have also collected a large amount of monitoring data on other physical, nutrient, and chemical characteristics of the Lower Santa Ana River that contribute substantially to helping understand the complex and dynamic system. Some of these data are still being analyzed, and staff is searching for funding to provide additional analyses of these data.

There is a significant amount of evidence in the record that indicates that urban runoff from the Santa Ana River and Talbert March are a major source of pollution at Huntington State Beach, while some other evidence clearly indicate other sources of fecal indicator bacteria (FIB) contribute to the pollution along the shoreline. Because there is still some unidentified source of FIB, it is not possible to state that urban runoff is the only cause, or what percentage of the pollution is attributable to urban runoff. Some preliminary load estimates by Dr. Grant and his team indicate that the river may contribute between 0% and 70% of the FIB found along the shoreline. (Kim, J.H, 2003, in preparation) There are also times where the concentrations of enterococci bacteria along the shore exceed the concentrations in the river by an order of magnitude.

The following summarizes the evidence in the record that supports the fact that urban runoff discharged from the Santa Ana River causes or contributes to violations of water quality standards for body contact recreation along the Huntington Beach shoreline.

1. According to A. Barrnett, MBC, 1999, based on his demonstration with oranges, there is a flow pathway from the river to the 6N area. This hydrodynamic experiment clearly showed that discharges from the river and marsh are spread along the shoreline, and that if the discharge goes beyond the surfzone, the water from the river can impact at 6N and 9N.

2. The discharge from the Santa Ana River and Talbert Marsh was also shown by the dye test performed by B. Jones (USC, 1999) to impact the area between 6N and 9N.

3. Preliminary load estimates indicate the SAR is a significant source of FIB to the surfzone.

4. Virtually all of the samples of urban runoff collected from urban runoff sources discharging into the Santa Ana River and Talbert Marsh have high concentrations of FIB. These samples were collected from urban runoff sources at between 25 and 50 locations throughout the watersheds during the investigations conducted by Dr. Grant between 1999 and the present. The discharge from the Santa Ana River to the ocean exceeded the geomean water quality objectives for body contact recreation for more than 58% of the year 2002.

5. RNA F+ coliphage and some DNA phages were found at every station sampled in the Talbert and Santa Ana River systems, showing that there may be human waste present in the urban runoff at all locations sampled throughout the watershed.

OCSD has conducted several sanitary surveys of their sewage collection system near the shoreline since 1999. These surveys have included geopysical surveys to try to find all subsurface pipes and possible pathways for sewage to reach the shoreline and any sources of leaking sewage. Only small sewage leaks were found in the plumbing system for the restrooms at Huntington State Beach. All of OCSD's sewer system facilities have been found not to be leaking sewage, and are probably not the source of the pollution along the shoreline. Additionally, after investigating the groundwater beneath leaking sewers throughout Huntington Beach, Komex Engineers concluded that there was no evidence of sewage impacting the ground water. In fact, only a few of more than 100 groundwater samples have ever shown detectable concentrations of the FIB indicators, with most of the samples showing non-detectable concentrations.

OCSD's Source Control Division completed a Sanitary Survey in 2002 that has been used by the City of Huntington Beach, the City of Newport Beach, and Board staff to help eliminate potential sources of fecal pollution to the shore zone. The sanitary survey identified 18 possible sources of fecal bacteria along the Huntington and Newport Beach shoreline. Staff has worked with both cities to investigate the significance of these fecal sources and to eliminate as many sources as possible.

Many of the 18 potential sources of fecal contamination identified in the OCSD sanitary survey were urban runoff sources and possible leaking sewers. The California Department of Parks has investigated and hydro-tested all their restroom facilities twice and have found no significant leaks. One minor leak was

repaired, but was not believed to be sufficient to cause the beach pollution problem. The Cities of Huntington and Newport Beach have also checked their respective beach restroom facilities, as well as their sewer systems near the coast, and have not found significant leaks that could be contributing to the beach pollution. These two cities are also working on many repair and retrofit projects for their sewer systems to repair the leaking sewers identified in the sanitary survey and their own sanitary surveys.

Regional Board staff contacted the staff of the National Oceanic and Atmospheric Administration (NOAA), to determine if there was an inordinate number of seal or sea lion deaths reported along Newport and Huntington Beach, as part of the investigation of the burial of these dead animals on the beach as a potential source of fecal bacteria. NOAA staff reports that sea mammal deaths along the shore are within normal ranges and do not indicate an increase from previous years. The burials of the dead mammals along the shore is also very sporadic, and staff could find no evidence that State Park staff were burying more than a few sea lions along the shore from the river mouth to 9N, indicating that this may not be the explanation of the high FIB found and 6N and 9N.

The California Energy Commission required the AES Power Plant to conduct a very thorough investigation of the plant, following the recommendations of the sanitary surveys and to further investigate Dr. Grant's hypothesis that the AES discharge was drawing the OCSD's discharge plume towards the shore, and thereby contributing to the shore zone pollution found between the river mouth and the power plant. The Board contributed funds to this investigation to expand the source tracking tests done by the investigators. The main findings of the investigations are that there are several non-storm water discharges of urban runoff into the AES power plant, which are routed into their cooling water discharge to the ocean, and that birds contribute to the fecal coliform found in the AES discharge ponds. The source tracking tests that were done did not find evidence of human viruses, using one test method, and found a limited indication of human fecal waste sources using another method, in all the samples tested including samples collected along the shore line. (J. Fuhrman, USC, personal communication) They did not find any evidence that sewage from within the AES plant was getting into the power plant discharge system. The researchers for the CEC recommended a need to control pet waste on Caltrans' property at PCH and Newland.

Dr. Grant's investigation of the Talbert Marsh found that birds are probably contributing enterococcus bacteria to the shorezone between the river mouth and 9N. This source of fecal material comes from birds feeding on the mudflats of the marsh and from birds roosting on the PCH bridges across the river and marsh outlet. The City of Huntington Beach and Komex Engineers conducted an investigation of bird groupings along the beach from the river mouth to 9N, with simultaneous water quality monitoring. This shows that birds are contributing to

the beach water pollution, but the percent of the problem that is attributable to the birds is not known.

Figure 3 shows a plot of the 15-Day Running Geometric Mean density of enterococci bacteria at Huntington State Beach, and the discharges from the Talbert Marsh and the Santa Ana River, from May 2000 through March 2003. The 15 samples cover an approximate time period of 25-30 days during each of the monthly monitoring periods. The plot of these data show that when the diversion of urban runoff occurred during 1999 and early 2000, there appeared to be a decrease in the geomean enterococci concentration along the shoreline from the river mouth north 9000 feet. There also appears to be an increase in enterococci density in March and April 2001, due to the removal of the diversion from the Santa Ana River. When the diversion was put in place in May 2001, the enterococci densities along the shoreline dropped again. And finally, the concentration of enterococci rose again after the diversion was removed in October 2002. This is a plot of daily monitoring data from OCSD's beach monitoring program, and provides further significant evidence that the discharge of urban runoff is a cause of pollution at Huntington State Beach. When this discharge is not present, water quality along the beach meets, and is better than, the Ocean Plan criteria most of the time. These data also show that there is still an identified source, or process, that causes more violations of the objectives than can be attributed to the discharges from the Santa Ana River and Talbert Marsh, by direct correlation.

Figure 3: 15-Sample Running Geomean Enterococcus Density at Huntington State Beach

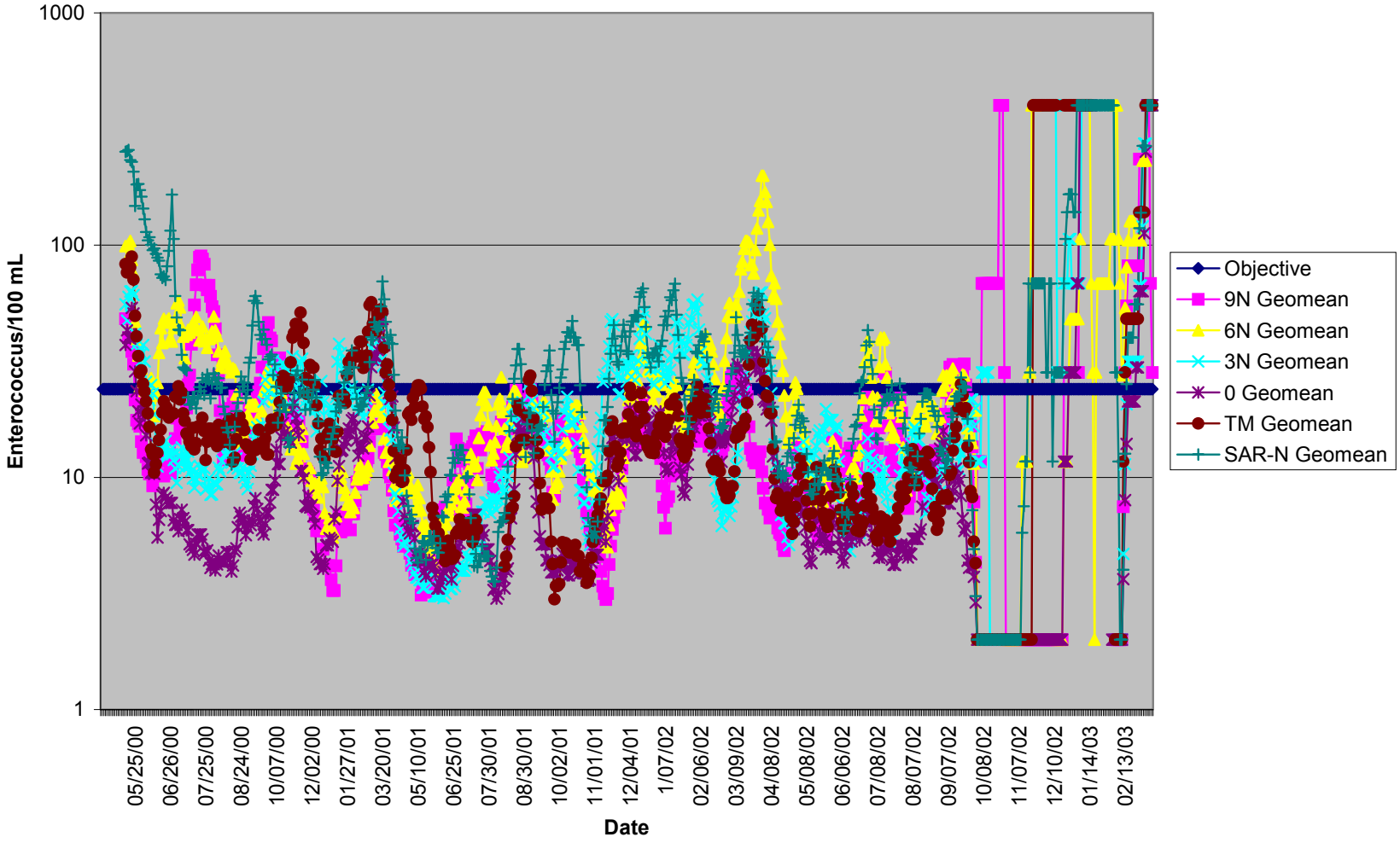

Figure 4: 15-Sample Running Geomean Enterococci Density at Huntington City Beach and Bolsa Chica State Beach

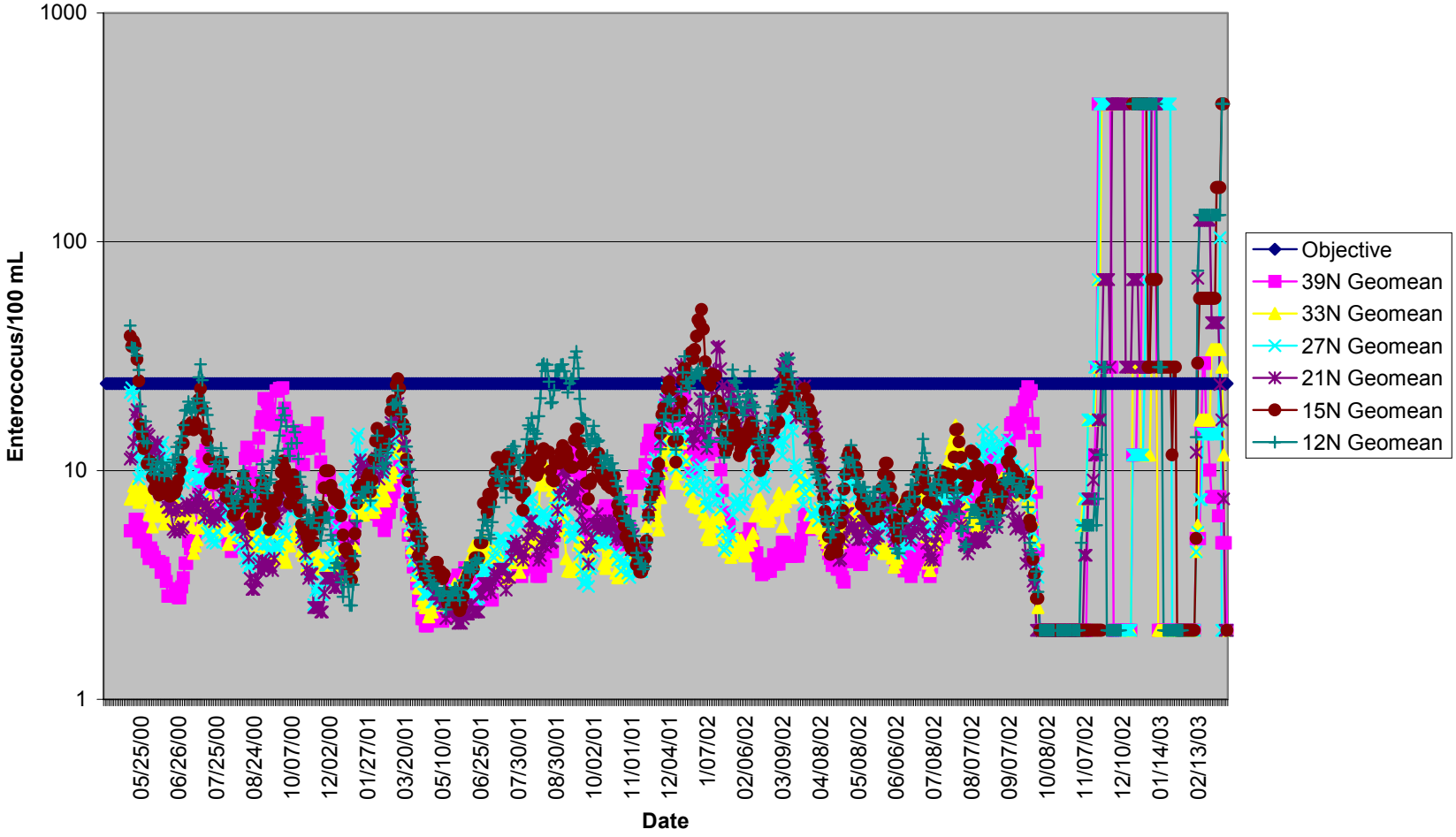

Figure 5: 15-Sample Running Geomean Enterococcus Density at Newport Beach

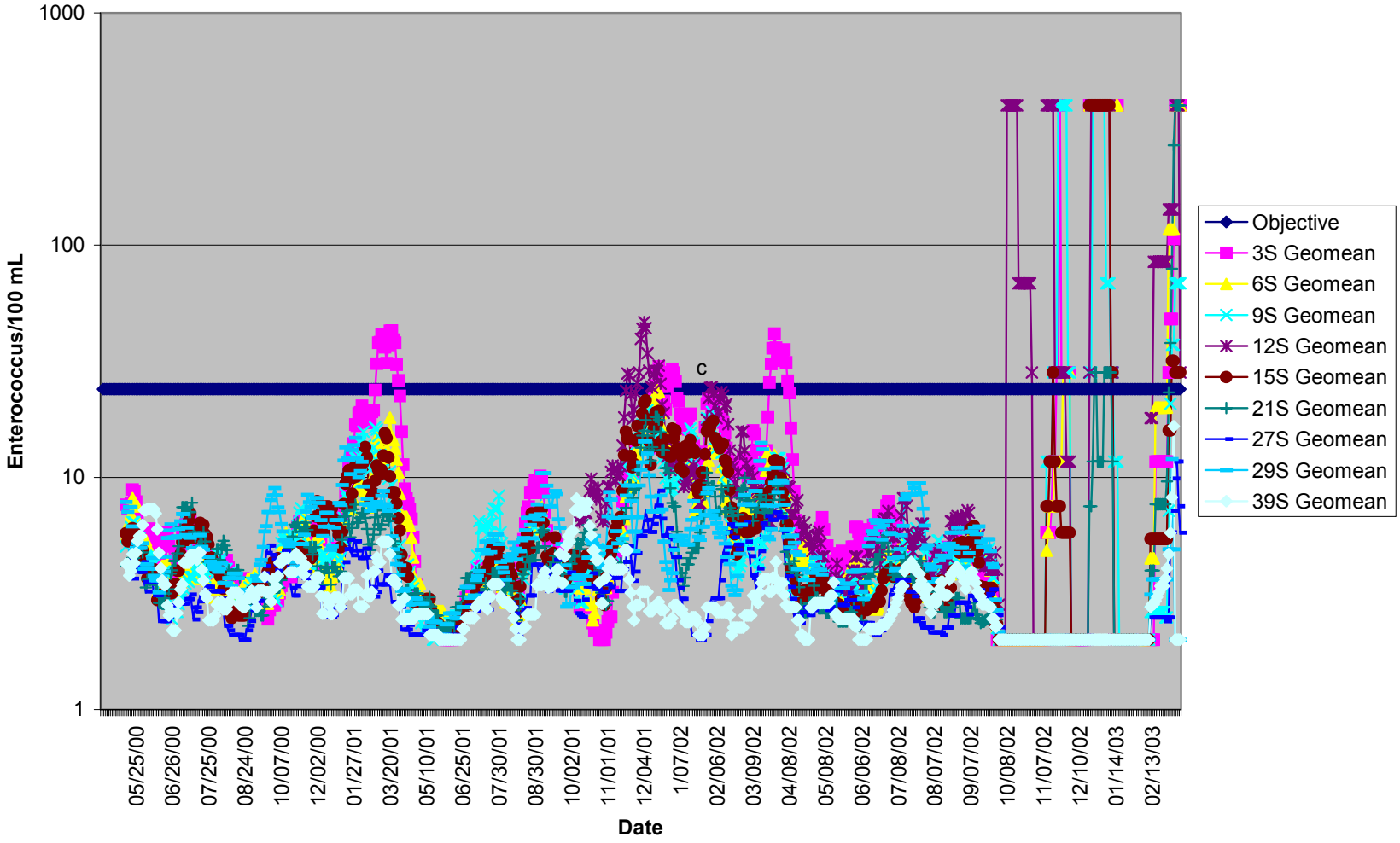

Figure 4 shows the 30-day running geometric mean enterococci density at Huntington City Beach and Bolsa Chica State Beach. Figure 5 shows the same for Newport Beach. These two figures show that water quality along these sections of shoreline routinely meet water quality objectives in the Ocean Plan for the protection of body contact recreation. If the dose response relationship in USEPA's water quality criteria for enterococci is linear below the 14 enterococci/100 mL that was shown to cause 14 out of 1000 cases of HCGI, then there should be less than 8 to 11 cases of HCGI when the geometric mean density of enterococci is between 4 and 8/100 mL, as is the case at these beaches.

Finally, staff has not seen any evidence that indicates that the OCSD offshore discharge of 240 MGD of treated wastewater is impacting beach water quality, at least in terms of the fecal indicator bacteria that are monitored. As discussed above, Dr. Grants findings of fecal indicator viruses seem to indicate the possibility that remnants of the offshore wastewater plume may reach shore. However, these data do not show viable viruses, so the health impact of these findings is unknown. Additionally, since the water quality criteria are based upon the health risk of swimming in a wastewater discharge plume, where the geometric mean density of the FIB was approximately 400 organisms/100 mL resulting in 19 out of 1000 (1.9%) illness rate for gastroenteritis, the less than 20 fecal coliform/100 mL found along most of Huntington Beach would pose a significantly less health risk. This health risk from the plume is also significantly reduced by the current disinfection by OCSD, which is disinfecting more than 90-99% of the viruses and other pathogens in their discharge. As shown in Figure 1, the geometric mean enterococci density along the Huntington State Beach shoreline is below the 24 enterococci/100 mL objective in the Ocean Plan along most of the beach, indicating a health risk less than 17 out of 1000, or 1.7% of the people exposed to the water by swimming.

According to "Huntington Beach Shoreline Contamination Investigation, Phase III, Coastal Circulation and Transport Patterns: The likelihood of OCSD's Plume Impacting the Huntington Beach Shoreline", (USGS, 03-62, 2003):

"…there were no direct observations of either high bacteria concentrations seen in the OCSD plume at the shelf break reaching the shoreline in significant levels or of an association between the existence of a coastal ocean process and beach contamination at or above AB411 levels. It is concluded that the OCSD plume is not a major cause of beach contamination: no causal links could be demonstrated. This conclusion is based on the absence of direct observation of links between bacteria in the outfall plume and beach contamination, on analysis of spatial and temporal patterns of shoreline contamination and shoreline processes, and on the observation of higher levels of contamination at the beach than in the plume."

Discharges of urban runoff via the stormwater drainage system are non-stormwater discharges that are causing, and/or contributing to, violations of water quality standards, in violation of the areawide stormwater NPDES Permit. These discharges are having a significant environmental health and economic impact on the people who use this beach. The stormwater permit requires that all the dischargers eliminate all non-stormwater discharges that cause or contribute to violations of water quality standards. All discharges of urban runoff must have less than 24 mpn/100 mL enterococci and 200 mpn/100 mL fecal coliform to not cause or contribute to violations of water quality standards. The Shoreline Drive stormdrain contributes high bacteria to the lower Santa Ana River and the surfzone. Other stormdrains also discharge to lower Santa Ana River, Huntington Harbour and Newport Bay. It is clear that diversion of these non-stormwater discharges that cause and contribute to violations of water quality standards, almost without exception, falls within the realm of the Maximum Extent Practicable (MEP) standard in the area-wide stormwater permit and must be addressed. These urban runoff discharges may include the sewage spilled during approximately 30 sewage spills per month, which may average as much as 1000-3000 gallons of sewage discharged per day. These discharges must be minimized in order to protect water quality and the beneficial uses of the Pacific Ocean along the region's shoreline and in Newport Bay and Huntington Harbour.

According to a study of the health effects of swimming in polluted urban runoff in Santa Monica Bay, there is a lower risk of illness from urban runoff as compared to the risk found by the USEPA in the development of the water quality objectives for bacteria from wastewater plumes. According to Haille, et . al., 1998, there is approximately an 8 out of 1000 chance of getting ill from swimming in the ocean near a discharge of urban runoff where the enterococci density in the urban runoff discharge exceeds the water quality criteria. This study shows that discharges of polluted urban runoff cause impacts to public health and the loss of the body contact recreation beneficial use. However, The Health Risk Assessment for Newport Bay (EOA, 2001) concluded that the health risk of swimming in Newport Bay was less than 3 out 100,000, for a case of HCGI, and that spending $20 million to disinfect San Diego Creek to meet the Basin Plan objective for fecal coliform, would at most, reduce the number of HCGI cases that may occur from swimming in Newport Bay by 1 case per year. This risk assessment also concluded that the risk of illness from swimming in Newport Bay is below the background level of risk for similar diseases in the general population. EOA estimated that there are approximately 2.2 million cases per year of HCGI nationwide, which is an approximate illness rate of 1%, or 10 per 1000. Therefore, there does not appear to be a significant risk to public health posed by swimming at any of the region's beaches, including Huntington State Beach, when it isn't raining.

Since all these estimates of illness are strictly mathematical and not based on actual epidemiology at Huntington State Beach, staff also has investigated

whether there are a significant number of HCGI illness cases occurring at Huntington State Beach. Staff receives between 1 and 5 reports each year from people who suspect they got ill from swimming at one of the region's beaches along the shore or within Newport Bay and Huntington Harbour. The OCHCA receives a similar number. The lifeguards at Huntington State Beach have also not received any reports of suspected illnesses from swimming at the beach. Therefore, even if the reporting of illness is under reported by a factor of 1,000, there still would not be more than 1,000 to 5,000 cases per year of HCGI reported to staff and the OCHCA. Nor have the lifeguards noticed any missed training days for their Junior Lifeguard program, where 200-400 kids swim 5 days a week for 4-8 weeks each summer, for 3-4 hours each day. The kids avoid the water when the OCHCA posts signs, but they have been exposed to the area that is apparently the most impacted in the region. The lifeguards report no reported illnesses for many years. Staff believes mathematical estimates of possible illnesses from swimming at the region's beaches are very weak, and are just not supported by the rates of these illnesses in the community. If there was an outbreak of 1,000 to 5,000 cases of HCGI in Orange County from swimming at the beaches, the Health Officer would probably be alerted by the doctors in the community, even if they are not required to report.

5. Conclusion and Recommendations

The Basin Plan establishes body contact recreation as a beneficial use of the Pacific Ocean, Huntington Harbour, Newport Bay, and surface water bodies tributary to these waters. To protect this beneficial use, the Basin Plan incorporates the Ocean Plan bacterialogical criteria. These criteria are health risk based, and if the criteria are met, there is less than a 17 out of 1000 chance of getting ill from swimming in the water. According to the USEPA, this level of health risk is an acceptable risk, and criteria providing this level of public health protection provide for compliance with the Clean Water Act requirements. The use of the criteria by the Regional Board to regulate discharges of urban runoff provides for the reasonable protection of the body contact beneficial use of the Pacific Ocean, in accordance with the requirements of the California Water Code.

The following is a list of alternatives available to the Regional Board to address continuing beach water quality problems at the few locations in the Region where water quality does not meet water quality objectives.

1. Enforce the stormwater NPDES permit by issuing a cease and desist order requiring the elimination of all non-stormwater discharges that cause or contribute, or threaten to cause or contribute, to violations of water quality objectives. Since all urban runoff has shown to be contaminated with high concentrations of bacteria, the order would apply to all urban runoff in the County of Orange within the Santa Ana River Watershed. Staff estimates that there is approximately 30 million gallons per day of urban runoff discharged from the stormwater collection system. Based on

the costs of existing diversions, staff estimates that it would cost approximately $30 million to construct the diversion system needed to convey all urban runoff to the sewer system. The cost of treatment for this urban runoff would be less than $4 million per year. Since the water code prohibits the Board from dictating the method of compliance, it would necessary to include effluent limits in the permit and allow any means to meet these limits.

2. Focused enforcement on individual discharges of urban runoff where evidence clearly shows impacts to beneficial uses. This enforcement would only address specific discharges. In this approach, staff would recommend the Board require discharges of urban runoff from all tributaries to the Pacific Ocean, Newport Bay, and Huntington Harbor meet specific effluent limits, or be eliminated by being diverted to the sewer system.

3. Continue implementation and enforcement of the existing stormwater NPDES permit to further reduce discharges of polluted urban runoff. This approach would also require some elements of 2, above, for those discharges of urban runoff shown to be impacting recreational use. Again, it is clear that diversion of certain specific urban runoff discharges meets the MEP standard in the existing area-wide stormwater permit, and successfully addressing these sources is required.

Staff is following the State Water Resources Control Board's Enforcement Policy in the investigation of violations of water quality objectives and standards at the region's beaches. When violations of water quality objectives are identified by the monitoring conducted by the OCHCA and OCSD, staff instigates an investigation of possible sources of the pollution. Staff is continuing the investigation at Huntington State Beach, with the County of Orange and the cities of Huntington and Newport Beach. Staff is also working with these agencies on implementing the TMDL for fecal coliform bacteria in Newport Bay, to address the few locations were violations are occurring. Since all the stakeholders and potential responsible parties are working in collaboration, we recommend that we continue with our implementation of Alternative No. 3. Staff may bring site-specific recommendations to address one or more of the beach pollution problems, at any time.

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